MANUFACTURE OF LARD

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MANUFACTURE OF LARD

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FOREWORD

A large part of all hogs which come to the meat packing plant must be disposed of in the form of lard. The making of good lard depends upon a number of factors including the type of hog, the feed it has consumed, its degree of finish, and all the things the slaughterer and renderer may do to the fatty tissue before it is sold as lard.

The proper removal, chilling and rendering of fatty tissues will result in a good lard being produced. There are many different parts of the hog which furnish fat and all of them require careful handling. Contaminated fats, sweepings and skimmings, and cured fats cannot be made into a first rate article. Materials for rendering should be properly selected and handled promptly.

Several types of deterioration may cause partial spoilage in lard. These include the formation of free fatty acid, the development of rancidity, and simple souring. Lards may be greenish, bluish, yellowish, or reddish in color. How to prevent some of these off-colors is discussed. Directions for steam rendering and dry rendering are given in detail.

The refining process may easily make or spoil a good lard. Precautions to be observed in refining are given, and, in the case of some lards, refining might be dispensed with entirely. This process never adds anything to the stability of lard, and may easily lower its keeping qualities markedly.

Hydrogenation is a process which hardens the lard and increases its keeping quality. Caustic refining removes free fatty acids and raises the smoking point. Usually it is wise to follow these processes by deodorizing the lard with steam. The proper use of these procedures is a great aid in making a good shortening out of such lower grade raw materials as sweet pickle fats and soft lard. The use of such methods is discussed.

But there is more to the production of good lard than proper manufacturing. Proper packaging and storing will do much in controlling rancidity.

Finally, salesmanship is needed to sell lard in competition with many other shortenings that are on the market. This booklet tells how science may be of use to the salesman of lard.

Robert R. Moulton

PART I. HANDLING OF FRESH FATS

There is one way to make good lard and only one way. This simple way is not to spoil it, for the hog who grows the raw material does *his* part to turn out a good product. He does this day in and day out, unless his owner puts one over on him by giving him too much of such feeds as contain a softening oil in sufficiently high concentration. With that exception the animal can be relied upon to give the packer a set of fatty tissues that are just right for fine lard. These tissues contain sweet and neutral fats with their natural, appealing flavor, and just about the right mixture of hard and soft fats to yield the consistency that is so characteristic of good lard and which the manufacturers of substitutes would give a million dollars to be able to imitate.

Of course the different tissues of the hog have fats of different degrees of hardness. On the outside of the hog are found more of the softer fats, while those laid on around the internal organs and within the body cavities are richer in the harder fats. This is true of all animals. As a rule, a mixture of outside and inside fats is best, and one can then vary the consistency of lard by varying the quantity of fat taken from the inside or the outside.

Again some tissues are richer in fat than others and so are more easily rendered. As a rule the tissue that is richest in fat is the one that is more easily rendered at lower temperatures and for this reason is the one that yields the best grade of lard. But the packer has little control over such matters and must use the tissues as the hog furnishes them. So he has had recourse to various methods of rendering in order to get the fat out of even those tissues that are relatively poor in fat and yield ten percent or less of the finished lard.

If the opening statement is true and if the packer, who has been making lard for more years than the writer of this article can muster, can be credited with making proper use of his time, why should space be used to discuss the subject of making good lard? The answer is that not all packers make good lard all of the time and some packers seem to have a hard time making good lard much of the time.

The average city consumer of small-package lard has been taught by rivals of the lard manufacturer to look for many things in lard which the packer has not in the past been obliged to consider. Among these are whiteness of color, blandness of flavor, and certain keeping qualities that no one but the manufacturer of packaged crackers and cookies need seek in shortening. So the packer must think about the quality of lard and try to see how he can make a better product. Perhaps the packer might stop trying to make *all* the lard and just concentrate on making the *best!*

Before getting down to what the reader considers practical matters, let me first tell him something about the way the hog makes the fat which the packer must use for his lard. If the hog is being fed on corn or other standard fattening feed he will have a good supply of starch which his body can convert to fat. This the hog does by means of enzymes which digest the starch and then enable him to store that amount which is in excess of his daily energy requirements. This surplus he stores in the form of that fat which the hog naturally makes. The same thing is true when he has an excess of protein in his feed, although here te process is not an econom-

ical one. But when he is given feeds that contain any amount of fat he can do less to them in digestion than he can do to the other things he eats. He can merely split the fats he eats into glycerine and fatty acid in order to get them through the wall of his intestines and then they are rebuilt back into fat, which is merely a chemical combination of glycerine and fatty acids. This fat, then, is transported by the lymphatic duct and the arteries to various parts of the body where the fat generally is laid down especially in those tissues of the body that are, for obvious reasons, called the fatty tissues. But the fat is also laid down in other places such as the bones and skin and in fact in almost every cell of the hog's body in some amount. The hog can pick and choose a bit and so he tries to keep his body fat of about one consistency and this he does by using more of the softer fats on the outside where they will be subjected to lower temperatures and more of the harder fats on the inside where the "fires of his body" are burning more vigorously.

When the hog is not getting enough to eat he can easily draw on his fatty tissues for a supply of fuel. This he does by means of those same enzymes which he used to get the fat through his intestinal wall in the first place. These fat-splitting enzymes are to be found in the hog's body wherever there is fat. This is an advantage to the hog; in fact it is a necessity and it does him no harm.

But this is not the case when the hog is taken over by the packer with a view to turning these fatty tissues into lard. After slaughter the fat-splitting enzymes proceed to start the fat on a downward course and it is a race between the packer and the enzymes to see who will win out. Often the packer loses by a nose; the nose of the buyer who has been taught to smell his fat before he buys it. The resulting free fatty acids start to reduce the keeping quality of the lard by speeding up the process of rancidity and so a vicious cycle is set going.

What can the packer do about this? Clearly, he cannot make a hog with no enzymes. But he need not give up on this account. He can build up his defenses against spoilage. They will help him make good lard and keep it good. These defenses in the case of lard are cleanliness, sanitation, and low temperature. Recent work done by the Institute of American Meat Packers under the direction of Dr. W. Lee Lewis, Director of the Department of Scientific Research, has shown that these defenses mean little in the case of enzymes. While cold does, as a rule, slow down the speed of a chemical reaction such as that carried out by the enzymes, this work has shown that free fatty acids are formed in fatty tissues stored at 37°F. and that the amount increases with the time. In other words, cold storage is no protection against free fatty acid formation in parts of the hog carcass held at cooler temperatures. But research further shows that the enzymes are retained in the fatty tissues or are killed by the rendering process so that by the simple expedient of rendering the tissues while they are fresh, one can obtain lard with a minimum of free fatty acid. The ideal method, as far as preventing free fatty acid formation is concerned, would be to render all hog fats as soon as the animal is dispatched without any chilling. In the case of carcass fats this cannot be done, but in the case of killing fats it can be done and it is done by some packers in the case of the leaf lard.

The primary purpose of making lard is to make money, and this still holds in the case of good lard. Why make good lard if one can make no money at it? This would seem to be a pertinent

question. The answer should be that if one cannot make money with high grade lard one should not expect to make money with an ordinary grade of lard. Certainly no one should expect to make money when employing careless practices that lower the quality of the product manufactured.

With this preliminary statement out of the way, this article will now get down to details. The place to start is with the first handling of the hogs by the packer. All precautions should be taken to protect the animal against bruises or other damage to his carcass since the trimming out of bruised spots reduces the amount of tissue that may be used for lard by just that amount. Bruised, bloody, and dirty tissue should never be put into the rendering vat or into the fat melter. Such practice is forbidden in inspected houses and should be as rigidly prevented in plants not under Federal inspection. Therefore, see that the hog comes to the sticking pen in fine shape. The hogs should be well bled, the shoulder-sticking should be stopped. The scalding should be carried out in a proper manner, both under and over-scalding being avoided. On fat hogs especially, some of the most valuable tissues are found just under the skin. Over-scalding makes a tender skin that is sure to be broken in the dehairing machine, and so good lard-making material will be damaged.

Shackle bruises should be avoided as well as all other types of damage due to bad handling before sticking. When the animal is opened, one should avoid cutting the viscera for any contamination will spoil the damaged tissue for lard. The bung dropping needs watching and it will pay to do this from behind the carcass and to tie the bung so that none of the contents is allowed to escape. In fact all of the operations on the killing floor should be done so as to prevent any and all contamination of the lard-making tissues.

The leaf lard should be pulled out all in one piece. This is the hardest, highest yielding, and most valuable fat on the carcass and is frequently used for making the high grade kettle rendered or neutral lard. If this fatty tissue is not to be rendered at once it should be sent the minute it is removed to the cooler where it is spread out or hung on hooks so as to allow it to cool out very promptly. The accumulation of this fat in trucks on the killing floor is very bad practice. Any small pieces of leaf lard left in the carcass are scraped out and used for prime steam lard as a rule.

When it comes to the ham facing operation it should be remembered that fat is more valuable on the ham than it is as lard. Flanks should be carefully handled and it is best to use hooks called flank props to hold up the flank thus insuring proper and rapid chilling of this region. All gut fat should be scraped from the hams at this time and all excess fat removed from the neck and brisket bones. When finished, the carcass should be sent promptly to the cooler and chilled rapidly in order to slow down the action of the fat-splitting enzyme and prevent the growth of bacteria which also act to reduce the quality of the lard produced from the fatty tissues.

Having disposed of the carcass, attention will now be given to the various parts that must be worked up into edible material while still warm. This includes the heads, the contents of the animal body and such parts as the feet and tails. The handling of heads will depend upon what edible specialties are being made. There are many parts which can be used for lard if no other disposition is made of them. There is the skull fat, jaws

and skulls, ears, snouts, and the fore part of the head—all of which need some special treatment if they are to be used for lard. The ear tubes must be removed from the ears, and all nasal cartilage and meat must be trimmed from the snouts. Trimmings from pork cheeks may be used for lard. When jaw bones are used, the teeth must be removed by a special grinding machine so that there will be no chance for contamination to occur from abscesses at the roots of the teeth. The head must be split and all teeth and turbinated bones must be removed, the nasal passages being thoroughly cleaned.

From the viscera many miscellaneous fats are prepared for lard. There is the bung gut fat and the caul fat which need only to be removed in a cleanly manner. Fat may be removed from the stomach or the organ itself may be tanked after the removal of the pepsin part, provided the stomach is well cleaned. As much fat as possible is removed from the middle or black gut, and the ruffle fat is also used. Fat is also removed from the pluck, and the trachea may be sent to the lard tank.

Pigs feet, ears, and tails may also be turned into lard. The feet have had the toes removed on the killing floor and they have been made free of hair and scurf, and have been well trimmed between the toes. The treatment of the ears has already been given, and the tails need no special attention save to insure their cleanliness.

All of these products should be sent promptly to the rendering department or to the coolers. Chutes used to transport the materials must be so designed that a minimum of fat is retained in the chute. This means smooth, rounded turns and in some cases a stream of water running down the chute. The chutes are hard to clean in the case of the leaf lard and some operators prefer to use trucks. If this is done, every precaution should be used to insure immediate delivery to the chill room.

Perhaps a few words should be said about the casing room where all fat adhering to the viscera is removed and used for lard. It is good practice for the viscera tables to be located near the head of the rendering tanks. Movable viscera tables are used in the larger houses, but when stationary tables are used, the lard fat goes to a central trough which sends it to the fat washing box. This is a two compartment affair, one compartment receiving the fat and the other serving for washing the fat under a fine spray. It should be remembered, however, that no amount of washing will make up for contamination of the raw material with intestinal contents. The fat should be inspected in the fat box.

In flushing out the bungs, contamination of the fat may be avoided by the use of an S-shaped pipe or an apron-like fixture on the pipe so that the overflow water and dirt do not fall on the bung and contaminate the fat. Another precaution is a conveyor which has individual hooks on which the bungs are hung when sent from the stripper to the washer. However, when one operator does the entire job the danger of contamination will be reduced. The trimmer should carefully remove all fat. The small casings should be pulled free from the ruffle fat without leaving any fat on the casings or scoring or breaking them. The middles are passed to the fatters who also must do a complete and careful job. Bladders are trimmed free of fat.

Fats from the cutting department are of course from chilled carcasses. The work of the Institute referred to above has shown that one or two days storage of the carcass at cooler temperatures will

not affect the free fatty acid content of the back fat while the leaf and ruffle fat will show but a slight increase in that time. It would appear, then, that the carcass fats are not deteriorated by the chilling procedure. At any rate such a practice is necessary for the production of good fresh cuts.

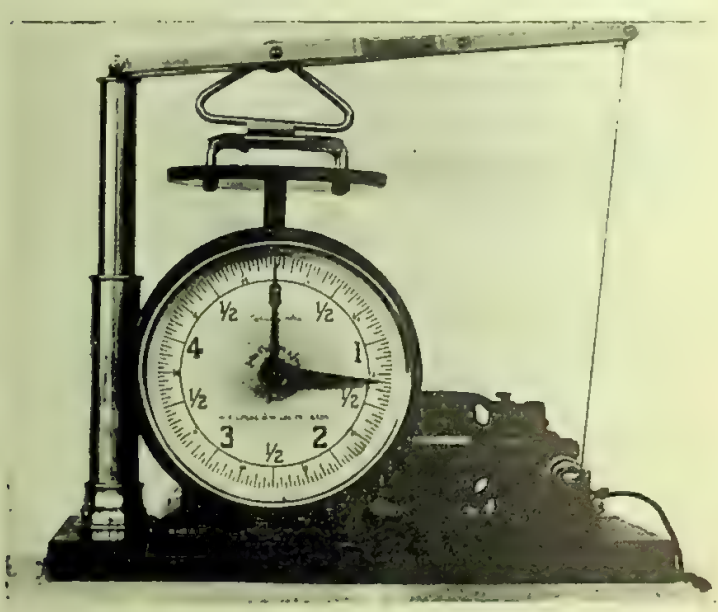
In the cutting room the trimming tables should be made of some good stainless metal and only the actual cutting edge need have a suitable wooden strip so as not to harm the cutting knives. The carcasses should be, preferably, at a temperature of 34° to 36°F. when cut. The trimmings that contain fat, and are not needed for sausage, may go to lard. In general the cutting fats are softer than the killing fats for reasons already given. Fat backs may go to the dry salt department or to lard. They must be skinned if they are used for kettle rendered or neutral lard.

Pickle trimmings from the curing department or from ham boning may also be used for lard. Any fat that has been cured and held for a number of days even at cooler temperature is an inferior type of fat for good lard. The free fatty acid content is sure to be high and nothing short of caustic refining will take care of that. Also fats made from such trimmings are reddish in color. By proper blending of such fats with fats of better quality and color, an acceptable lard can be made. But it should be remembered that no amount of blending will do away with the fact that pickle trimmings make a fat that will harm any good edible fat

PART II. EFFECT OF STORING, CURING AND RENDERING

Since the average hog runs about twelve percent of lard it is of great importance that the packer get everything out of the hog that he can. As will be shown later, this does not mean that the packer should put into lard everything that contains fat, regardless of how the material has been treated. Such a practice will, in the long run, prove expensive to the packer. While neutral lard and kettle rendered lard are both made by the meat packer they constitute such a small fraction of the total production that consideration of them will not be undertaken in this series of articles. Prime steam and dry rendered lard account for over ninety percent of the total, and while the production of dry rendered lard is still small in amount compared to the prime steam lard, it is coming into a deserved popularity and is capable of use in the case of much of the tissues that the hog carries.

Steam lard is made from the cutting and killing fats. The latter includes such fat sources as heads, head skins,



The Bailey Shortometer used in investigations of the value of different cooking fats as shortening agents. The instrument measures under uniform conditions the breaking strength of crackers or plain pastry made with shortening. The lower the breaking strength the higher is the shortening value. This instrument in thousands of tests proved lard to be the best shortening agent available. (Institute Photo.)

stomachs, ruffle fat, gut fat, ham facings, bung fat, gullets, caul fat, leaf lard scraps, and the like. Such sources represent between one-fourth and one-third of the total lard production, although the proportion varies from day to day on account of variations in the regularity of kill. In many plants killing and cutting may not be done the same day. This makes little difference in the larger houses since they render these fats separately from the cutting fats, but it will make a difference in those houses which render the two main classes of fat together. Cutting fats include shoulder and ham trimmings, feet, belly trimmings, fat backs, leaf lard scraps, clear plates, neck and backbones, and lard hogs, or hogs whose flesh is not suitable for curing but is perfectly wholesome for rendering into fat.

As was stated in the first article of this series, the fats of the hog vary in hardness because of the region where they are formed. The hardness increases from the outside towards the inside, the hardest fat being that around the kidneys and the softest being the outside fat along the back and loins. On the average, cutting fats have a titer of 36°C. (65°F.), while the leaf lard has a titer of 41°C. (74°F.). However, certain feeds may affect the fats and make them softer than is normal. Such feeds are peanuts and soy beans. Hog raisers and packers in the United States hold the opinion that corn gives the normal fat in the hog carcass. Yet the fat of the corn, when fed as corn oil, is a softening fat, and the bacon factories of Great Britain class corn as softening when compared with barley or other feed that is very low in fat. Because of the differences in consistency between the inside and outside fats, the packer frequently prefers to mix the two classes of tissue in his rendering operations in order to get a lard of the desired consistency and uniformity. Such mixing may be done with the lards that have been rendered from the two classes of fatty tissue, and in this case it is even possible to make use of some fats that are too soft of themselves to make an acceptable lard. This must not be overdone, however, since the only way to successfully dispose of very soft fats which may be on hand in quantity is to subject them to the process of hydrogenation, a process that costs something to carry out.

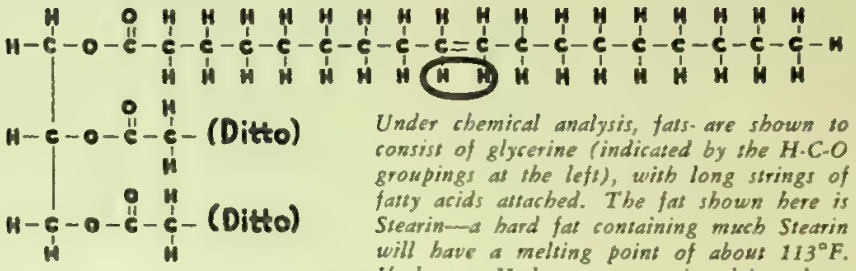
There are two methods of transferring the raw fats from the killing or cutting floors to the place where they are to be rendered. One is the use of trucks, and is subject to this criticism that fats are apt to be held too long on the floor before they are sent to the rendering unit or the cooler. The second system is the use of a blow line where the rendering department is far from the cutting and killing floors and where large quantities of raw materials are used. Of course, when the rendering department is located beneath the cutting and killing floors it is best to send the raw fats on their way down a well-made gravity chute. In this case, and especially in the case of the blow line, it is necessary to see that the line is constructed so that the fats can be sent through easily, and both chute or line must be capable of easy and thorough cleaning. With the blow line installation a small tank is placed in the department of origin and into this the fats are placed. When the tank is full, the lid is put on and the outlet at the bottom is opened. Then steam and air under pressure are admitted above the fats which are thus forced through the blow line to the rendering department. The delivery pipe must be large and free from sharp turns, and one should use only long sweep ells. Great care should

be taken in the construction of the blow line so that there are no pockets or pits in the surface where some of the steam and fat may be left after the clean-up. Should this be the case, the fat will turn rancid or build up a sufficiently high free fatty acid content even overnight to affect the batch of fat to be sent through the line the next day. Also a bit of rust is a fairly good catalyst for lard fat. In plain English a little iron rust or other metal, such as solder, speeds up the formation of free fatty acid and products that are responsible for the rancid odor and flavor in fats. So a blow line needs watching, and, for that matter, so do all of the containers with which the raw fats, or the lard in any state of processing, come in contact.

Both pickle trimmings and neutral lard bottoms may be put into the tank for steam lard. The former is always high in free fatty acids due to the time that has elapsed between the cutting of the hog and the trimming of the cured product. The temperature of the pickle cellar is no protection against such deterioration since it is caused by enzymes, as was stated in the previous article, and the temperature of 36°–38°F. does not stop the enzymes from working. The neutral lard bottoms result from the settling by salt, of the neutral lard in the process of manufacture and they are generally rendered with the pickle trimmings. Lard made from these two sources is darker in color than other lards and poorer in quality.

Variations in the pickle trimmings that are available for the manufacture of lard result from irregularities in the boiled ham business which is often heavy when the lard production is lowest. In order to hold up the high quality of their lard some houses develop a special outlet for this dark and high-flavored lard. There are also other sources of lard that will yield an edible product. Some of these are skimmings from the slush box which is located under the steam rendering unit and even the press-room skimmings, if this is run on an edible basis. However, the use of the latter product is a very risky business and is best avoided. In the opinion of the writer it would be better to take all of these miscellaneous sources of lard and subject them to a special process of caustic refining, hydrogenation, and blowing with steam, or deodorizing, rather than to try to dispose of them by putting them in the regular lard and so making of it a much poorer product than it should be. Caustic refining alone lowers the acid in the lard, raises the smoke point, and lightens the color. It also increases the cost, especially if the plant has only relatively small amounts to dispose of. A way out of this difficulty could be found if one plant in a community would undertake to do all of the caustic refining, hydrogenation, and deodorizing of the poorer raw materials which are produced in the neighborhood or even in a larger region such as a city or county.

As has been stated, the lard from pickle trimmings is reddish in color. The cutting fats generally give a lard that is a blue-white in color, while the killing fats produce a lard that is greenish. Blending may be resorted to as a means of hiding the undesirable color but the refining process is usually relied upon to do this. These differences in color are due to variations in the ratio of two colors that are found in the hog fats. These colors are red and yellow. An instrument called a tintometer is provided with colored glass pieces called Lovibund glasses which may be inserted in the instrument until the color of the melted lard is exactly matched. In this way a color that might not be thought to



Under chemical analysis, fats are shown to consist of glycerine (indicated by the H-C-O groupings at the left), with long strings of fatty acids attached. The fat shown here is Stearin—a hard fat containing much Stearin will have a melting point of about 113°F. If the two Hydrogen atoms ringed in red are taken out and a double bond made between the two centre Carbon atoms, we have Olein, which in quantity makes a fat soft and may give a melting point of 82°F. Palmitin, a bit softer than Stearin, is two Carbon atoms shorter. Stearin is soluble in the softer fats; when the proportions are correct an ideal lard is produced.

be abnormal by the casual observer can be shown to be too high for a good quality lard. With the exception of pickle trimmings however, the color in the lard has been put there by the animal and so might well be considered normal.

The process of rendering should be well understood by all lard manufacturers and it scarcely seems necessary to take space here in reiterating that understanding. Nevertheless there are a number of points in the operation of the rendering and refining units that should be kept in mind which some producers of lard may be neglecting. Rendering tanks are a problem that is always with the packer since they corrode and need to be replaced from time to time. It would seem self evident, then, that it would save money to have a thick tank which will not need to be replaced as often as a thinner one. Another matter of importance is the installation of the tank which is usually so big that it extends through more than one floor. The tank should be suspended below the loading floor with a neck projecting up from the dished head of the tank through an opening in the floor. It used to be common practice to build the concrete floor around this neck so that water and dirt from the floor above would be kept off the tank. This practice allowed the tank to rust where it touched the concrete and was a source of much expense to the packer. The modern way of installation is to allow a space between the tank neck and the floor so that the operation of the tank will not send its vibrations out through the floor thus damaging both the floor and the tank. The neck is provided with a galvanized iron cone which sheds the water away from the tank to the floor. It is an easy matter for a metal pipe of sufficiently large size to be cast into the floor when the concrete is laid and this may extend above the floor level to prevent water from getting through the opening. Of course, the tank should be covered with at least two inches of good insulating material.

Before starting the rendering process

proper, it is well to parboil the fats in order to remove the blood and other foreign matter that will be included. Such products always deteriorate the lard if left in. When rendering, the steam is admitted and the air is removed by leaving a pet cock open, or some operators leave a two inch relief valve partly open during the operation. To insure the proper opening of the latter, some operators use a small bypass in the exhaust line from the rendering tank. In this exhaust line there is a one-half inch valve which is left open during the entire operation. This insures proper circulation without any danger of steam, water, and lard being sent out through the two inch relief line.

While rendering is usually carried out for 8 hours at a pressure of 40 lbs. the time may vary with the particular raw materials being rendered. After the cook it is best to reduce the pressure in the tank slowly or the water in the tank will be sure to burst into steam due to the suddenly reduced pressure. The resulting emulsion is a great nuisance to the lard renderer. Next the operator sprinkles in a small amount of salt and allows the lard to settle for 2 to 3 hours. The contents of the tank will then be found in three layers: At the bottom there will be the bones and fiber; then there will be the salt water layer, and finally on top will be the lard. There should be draw-off cocks at the bottom of the lard layer, but if this is not the case the level can be adjusted by admitting or withdrawing water from the tank, through the drawoff cock. The lard is then drawn off through the upper cock. In some plants there is a lower cock of six inch capacity through which the remainder of the lard and the uncooked floating material may be removed by means of a long-handled wooden paddle.

The remainder of the material is then dropped out of the tank by means of the two-inch gate valve at the bottom. This material includes a mixture of fiber and cooking water with a small amount of grease and partly cooked material called floaters. This is heated to the boiling point and then allowed to stand quietly until the clear grease and floaters are on top. This may then be skimmed into a receptacle provided with a strainer which allows the grease to drain off. The uncooked material goes back to the tank to be recooked.

The lard from the above rendering tank goes to a separator tank with two partitions which allow an underflow and an overflow current as the lard passes through the tank. To accomplish this the first partition is set flush with the top of the separator tank and the second partition is set flush with the bottom of the tank. The first partition ends at least a foot from the bottom while the second ends 3 to 4 inches from the top. The outlet is at a slightly lower level than the second partition. Putting the lard through this separator tank removes the cook water. Any water or fiber that remains in the lard will damage it and so the greatest precautions must be taken to get rid of all of it. There should be 0.25% or less of this foreign matter in a good lard.

The lard next goes to a receiver which is a steel tank thirty inches deep. When operating this tank there is always two inches of lard in the bottom, left over from the last lot that was settled. Here one may get more settlings which are drawn off through a bottom cock. At the end of the day's run this is completely emptied and the material contained in it is sent back for recooking. The last water in suspension is removed by a slow, moderate heat applied through the jacket or coil of the re-

ceiver tank. A good test for complete drying is to fill a bottle with the hot fat which should remain clear even when it is cooled to about 100°F. From here the lard is pumped to the lard refining room.

Here again is a good place to insist upon absolutely thorough cleaning and drying of the pump and pipe line through which the lard is pumped. Any lard or moisture left in the pump or line will be sure to deteriorate and spoil the next lot of lard that goes through.

When the lard so prepared is intended for prime steam lard it is necessary to see that no skimmings, pickle trimmings, or other sources of poorer lard are put into the tank. Also when putting the lard into barrels it is first necessary to cool it to about 100°F. otherwise the hot lard will affect the barrels in such a way as to deteriorate them.

The Dry Rendering Process

In contrast to the above method of rendering is the dry rendering process which takes the hashed or crushed materials and melts them in a fat melter which may be placed horizontally and is provided with a steam jacket and a set of rotating arms which keep the materials in motion and prevent sticking. To help in this, some operators use some smooth pieces of bone such as good clean jaws which by scraping against the shell assist in the cleaning process. The great contrast with the other rendering method lies in the fact that the raw materials used here are melted in the fat formed and that there is no water to make stick the same being such a nuisance to dispose of. Instead, a good profit can be made on a high quality cracklings. Dry rendering also avoids both the long contact of the lard with the tissues, and the use of a temperature that is higher than that which should be used for the production of the very best grade of fat. In addition, the process allows the fatty tissues to be rendered while they are strictly fresh. All three of these differences permit the production of a lard that in the first place, is very low in free fatty acid and, in the second place, has very good keeping qualities. The flavor is somewhat different from that of prime steam lard and is much like that of the kettle rendered product. While this may seem to be a disadvantage to many producers of lard it should prove to be an advantage when one considers the better quality of lard that may be produced by the new method. This different and better flavor would then be associated with a very high grade of lard.

The water that is formed in the process of melting the raw materials by the dry rendering process is exhausted to the air, or to a vacuum, and condensed. The vacuum costs something to maintain but it permits the use of a lower temperature during the melting process and so results in a better lard. Fresh rendering, the use of no extra water, the prompt removal of the tissue, and the use of lower temperatures all result in the production of a better lard.

The properly melted material from this fat melter is discharged into a hopper or a tank with a perforated false bottom which allows the lard to drain off. The tissue is then put through a lard press or expeller. The lard that is drawn off may be treated as prime steam lard is treated, and the lard from the press is returned to the melter to be run through with the next batch.

A variation in this process may be made by giving the materials to be rendered a preliminary cook under the steam pressure that is generated by the material itself. The process softens the

bone and is said to result in a better color.

The dry rendering process was originally delayed in adoption on account of the difficulty experienced in always obtaining a sufficiently light color, and, as has been pointed out above, the flavor is different. The color is now brought largely under control by heating the fatty tissues in the fat melter under a vacuum. For these reasons the domestic and export trade, as well as the Board of Trade needs to be educated to the new product. In the opinion of the writer such education would pay well in the end, for the better lard produced will stand competition much better than does some of the wet rendered product. Finally the cracklings are much more easily disposed of than is the old tankage and stick.

PART III. REFINING DECOLORIZING

The process of refining or bleaching lard is carried out for the purpose of reducing the color. The fuller's earth or specially prepared carbons may be used for this purpose. Diatomaceous earth, infusorial earth or Kieselguhr as the product is variously called, is simply an aid to filtration or clarification and is of no value as a reducer of color. It may be used at times in connection with one of the decolorizing agents, but that is a different matter.

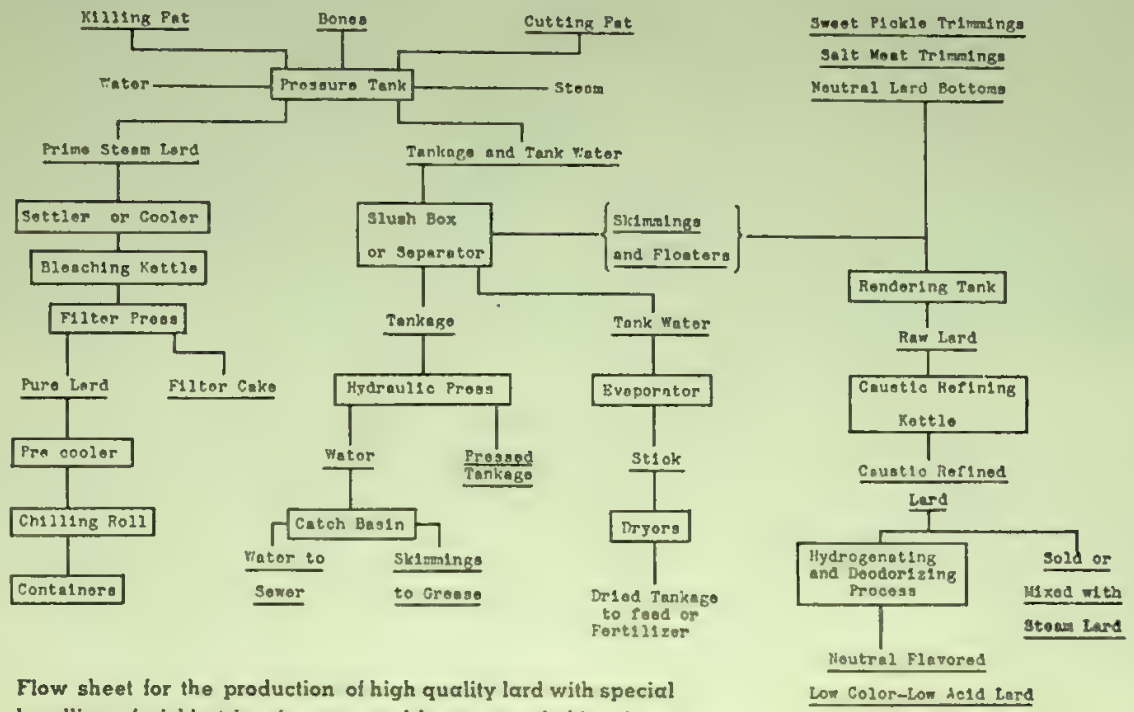
Fuller's earth is an impure hydrous aluminum silicate which resembles clay somewhat in chemical nature and some properties, but which, in contrast to clay, is not plastic. The product comes from both foreign and domestic sources and neither source seems any better adapted to its use than the other. The only way to be absolutely sure about your fuller's earth is to test it in a small scale test run and see what sort of a job it does and notice particularly the effect it has on the stability and keeping qualities of the lard that is refined.

The process of refining is, briefly, agitating the fuller's earth with lard in a refining or bleaching tank and then removing the earth by means of a filter press. The process never improves the stability, keeping qualities, or flavor of the lard, although it does give it a lighter color. Whether the refining process on the whole is good for the sale of the product will depend upon a number of things. First in importance is the amount of fuller's earth used, next is the length of time the earth and lard are in contact, and third is the temperature employed in the refining process. In the batch method not over three fourths of one per cent (0.75%) of earth and even as little as one third of one per cent (0.33%) of earth should be used. The temperature of the refining process should not exceed 180° Fahrenheit and it may be as low as 160° F. The lard and fuller's earth are agitated for no longer than 15 minutes with the agitator shaft going at a fairly high speed, for example 125 revolutions per minute.

The size of the refining tank and the details of its construction and operation can best be worked out by the plant's operating staff, with the aid of the manufacturer of the machinery and any outside technical help which is competent and which the plant management wishes to engage. However, it will be found that for a medium sized plant, a tank 8 feet in diameter and 8 feet deep having at the bottom a steam jacketed cone whose sides meet at an angle of about 90 degrees will be satisfactory. There may be steam coils placed in the tank itself, which should contain a properly installed set of agitator arms.

The bleaching or refining process not only lowers the color, but also removes moisture and impurities and gives a mild flavored lard. In general the greater the amount of fuller's earth that is used and the longer its contact with the lard, the greater is the reduction in the stability and keeping qualities of the resulting product.

Immediately at the close of the refining process and without any delay the lard is pumped to the filter press. The first filtrate is always cloudy due to failure of the filter cloth to hold back all of the fuller's earth. For this reason it is necessary to return the lard to the press and refilter it until the cake on the press-cloth is sufficiently thick to give a clear lard. Such a cake not only takes out all the fuller's earth of the next lard



Flow sheet for the production of high quality lard with special handling of pickle trimmings, neutral bottoms and skimmings.

which comes through, but it also is capable of bleaching lard that has not been treated with the earth. For this reason when large quantities of lard are to be refined, the latter portions of it need no refining material but can be run through the presses and will thus be bleached. This is known as the continuous process.

One practice employed to some extent to restore the original flavor of the lard before refining, is to mix some unbleached steam lard with the refined lard. This may be quite a help but it partly defeats the purpose of refining, which is the reduction in color.

There are a few rules that should be kept in mind when refining lard. First, the color standard at which the refiner of lard is shooting should not be set too high, for the more color taken out, the more fuller's earth is required, and the greater will be the reduction in keeping qualities. The second rule is to start with a lard that is dry, for the presence of water during the refining process will speed up hydrolysis and start the lard on the path to deterioration. The third rule is to use as little fuller's earth as possible in getting to your standard color. Fourth, the color obtained in refining should be controlled and checked to see that it is adhered to. And fifth, the bleaching should be done rapidly.

But to return to this question of loss of stability and keeping qualities which generally follows from the refining process. There are two or three questions which the lard refiner should ask himself. One is: To what extent should I attempt to get a light color and why do I need to do it at all? A second question is: What causes the lard to lose stability and keeping qualities and what can I do to make a lard that will not be so affected? Third, the packer should ask: Is there any alternative to refining lard?

In reply to the first question it should be frankly admitted that in this whole matter of color, flavor and length of time the product will keep under extreme conditions, the lard producer has allowed the manufacturer of rival products to set the pace. In fact, he has done more than that. In the battle of the fats he has allowed the "enemy" to select the field of battle, to choose the weapons, and to lay down the rules of war.

Why should lard be white when a high grade lard naturally has some color? Why should lard be made bland or flavorless when a high quality lard possesses a natural, pleasing and distinctive flavor? Why should a lard intended for the average consumer be made to compete in keeping qualities with a shortening (lard or otherwise) intended to be used in commercial biscuits and crackers where great stability is demanded?

To answer the last of these questions first, it may be said that lard can be made to meet these specifications. Also a well-produced lard made from raw materials that have never been abused will generally show very satisfactory keeping qualities. And again the procedure to be recommended later will help greatly to increase the stability and keeping qualities of your lard.

In answer to the next to the last question it should not be forgotten that the fine lard made as stated in the above paragraph has a flavor in the finished product and an odor during use that is appealing and distinctive. Proper selection and handling of raw materials, the exclusion of pickle trimmings, neutral lard foots, and skimmings from the regular lard tank, kettle or melter, and the use of little or no fuller's earth in refining will yield a lard that meets the

flavor situation, in the opinion of the writer. If there is a sufficient demand for a light-colored, bland lard that will have unusual keeping qualities, it can be made by caustic refining, hydrogenating, and deodorizing into a product of standard color and hardness and good keeping quality. The best quality can not be assured, however, in the case of all raw materials. Some selection is necessary.

In reply to the question as to why lard should be white, my answer is that it need not be. Color, except in the minds of some packer salesmen and in the opinion of some purchasers whose past experience and education (by manufacturers of rival products, perhaps) has centered their attention primarily on color . . . need not be a stumbling block to the lard manufacturer if he makes a *good* lard that meets present trade demands in other respects. It is largely a matter of salesmanship.

Now to return to the question of what causes lard to lose stability and keeping qualities. First, this article and the previous ones have dealt with matters of handling and selecting raw materials and with refining. Perhaps the whole question of spoilage of lard should be included here. On this assumption sour flavor will be dealt with first. This is due to bacterial action, or fermentation, which is fostered by the presence of tank water and residues in the unrefined lard, and can easily be prevented by proper operation as outlined in this series of articles.

The second type of trouble with lard is the building up of a high free fatty acid content. This is due to the enzyme in fatty tissues and can be prevented, and the free fatty acids can be held down to a low percentage by processing the lard promptly. Those tissues processed from the killing floor yield a lard very low in F.F.A. (free fatty acids). Good cutting fats only one or two days from slaughter are also satisfactory in this respect, especially if properly handled. Other fatty tissues and fats, including sweet-pickle trimmings, cured trimmings of any kind, neutral lard foots, and skimmings, will yield a lard of high F.F.A. content, color that is not satisfactory, and flavor that is wanting in quality. These should be given special treatment as shown later.

Rancidity is a third type of trouble that lard and other shortening agents may meet. Here it is not a question of bacteria or enzymes, but of catalysis and oxidation. In other words, rancidity is a process by which oxygen, from the air or from other sources, progressively attacks the fat and forms products which give the characteristic odor, flavor, and poor keeping qualities of a shortening that is rancid. The things which speed up or catalyze the rancidity process are light, heat, moisture, free fatty acids and certain metals such as tin, lead, copper and oxide of iron. Some lard that is already partly spoiled, the presence of some soap and of bleaching agents in the lard also help in the process of turning rancid. In plain words, the loss of stability and keeping qualities of lard is largely the same thing as the development of rancidity or incipient rancidity.

Therefore keep your lard away from light and heat. Exclude air if possible, remove all moisture and keep it out. Do not let free fatty acids develop, or remove them by caustic refining. Keep out all traces of tin, lead, copper or iron. Do not put some bad lard into good lard. Do not let any soap get into the lard and in the process of caustic refining remove all soap carefully. And last but not least use little fuller's earth and be sure it is all removed.

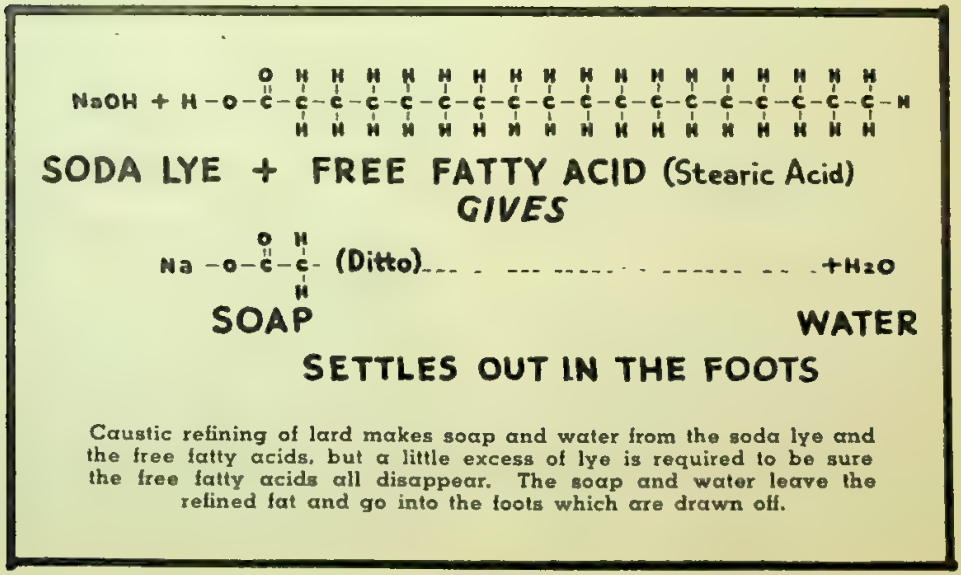
In the preceding article the structural formulae of stearin and olein were given. These two fats and palmitin make up most of lard. There is also a smaller amount of linoleic acid combined with glycerine as linolein. Olein is called an unsaturated fat because it is not saturated with hydrogen, as is stearin, but has two less hydrogens near the center of its chain of carbons. Linolein has more unsaturated spots. These unsaturated spots are the ones that are easily oxidized and, therefore, unsaturated fats turn rancid more readily than fats like stearin which are saturated. However, it is the presence of these very unsaturated fats which give lard its fine plastic range and unequalled shortening powers.

Now if two hydrogens can be added to each unsaturated spot in olein, it will become saturated and will then be stearin. Similarly, linolein can be changed to olein and then to stearin by the process of hydrogenation. At the same time the tendency to rancidity is reduced and the fat is made harder.

It would appear, then, as if it would be a good idea to hydrogenate some lards, especially those that might be too soft. However, this process of hydrogenation does not remove the free fatty acids and does not by itself improve the keeping qualities if there is much F.F.A. present. Also it gives an undesirable flavor and odor, but this can easily be removed by blowing with steam or deodorizing as it is called.

One might ask, therefore, why the lard renderer and refiner should not caustic refine, hydrogenate, and deodorize his lard? He should not do it to high quality material because it does not need it and because it alters the characteristic flavor. Also it costs some money, and here a penny of prevention is worth a dime of cure.

Now we are ready to talk about the way out of the packer's trouble resulting from bad handling and from the necessity of using sweet pickle trimmings, cured trimmings of all kinds, neutral



Caustic refining of lard makes soap and water from the soda lye and the free fatty acids, but a little excess of lye is required to be sure the free fatty acids all disappear. The soap and water leave the refined fat and go into the foots which are drawn off.

lard foots, and skimmings. First, of course, do not *do* any bad handling Second, caustic refine the lard from sweet pickle trimmings, from cured fat of any kind, from neutral lard bottoms or foots, and from skimmings. Then hydrogenate it to a standard congealing point and deodorize it. The resulting product can be added to good lard without prejudice to it, or can be marketed as a special shortening, preferably under a distinctive trade name. If the lard is caustic refined but not hydrogenated it needs no special lable or distinctive name but can be mixed with lard of the same origin such as prime steam lard or refined lard.

If these processes can not well be carried out at your plant and with the relatively small volume of product needing such treatment, it should be possible for the packers in your community to pool this type of lard and get all the caustic refining, hydrogenation, and deodorizing done at one central point. Or a separate agency might be set up to purchase this sort of lard, process it as shown, and then merchandise it. Such a product can find a market and give entire satisfaction. In fact there are two such products now on the market.

Caustic Refining

Caustic refining affects the clarity, color, taste and odor of lard, and also reduces the F.F.A. to a neglible minimum. A clear lard of lower color index and of bland flavor is produced. By removing the F.F.A. the smoke point of the lard is raised 100° F. or more. Such a lard will keep better than the untreated lard. If it is too soft, hydrogenation still further improves its keeping qualities. Caustic refining reduces the amount of fuller's earth that may be needed.

The process of caustic refining is a technical one, and should be done by one who knows how or who learns how to do it. A chemist is required to analyze and control the process. The same thing may be said about hydrogenation. Also the requirements in any plant call for special treatment and the attention of engineers and chemists of experience. Therefore, it will not be possible to set forth operating procedures that can be applied in total to your individual situation. However, the following suggestions will prove helpful. They are based on the experience of the industry and on work done by W. Lee Lewis and F. C. Vibrans of the Institute of American Meat Packers.

If the lard department has a clay kettle and a filter press the only additional equipment that will be needed is a refining kettle, which should be large enough to make the operation profitable and small enough to be in almost continuous use. The diameter of the tank, as with the refining tank, should be as great as its height above the cone. The cone at the bottom should have sides that meet at an angle of ninety degrees at the apex. The cone should be steam jacketed and steam coils should be installed in the tank. These should be placed so that they are always covered with fat during caustic refining and yet not so low that they will interfere with the foots. The coils should have a heating capacity capable of heating the lard to 140° F. in a reasonable length of time.

A charging line, a swinging suction draw-off line, and a four inch valve or cock at the bottom are desirable. The latter is for drawing off the foots. A variable speed agitator with the paddles set to throw the melted lard up is also needed. The speeds provided should be about 5 r.p.m. (revolutions per minute) and 20 to 30 r.p.m.

The amount of caustic soda and its strength may vary to suit the individual's experience. But a lye of 10° to 14° Baume is satisfactory, the lower strength being best for a lard of less than 1 per cent of F.F.A., while a lye towards the upper limit is best when the F.F.A. is greater. The amount of the lye required for exactly neutralizing the F.F.A. should be calculated. Additional lye should then be used which might run up towards 10% for low acid lard and 20% for high acid lard.

A measured amount of melted lard is placed in the refining tank and the lard is heated. Some operators prefer a low temperature while some prefer to use 135°–140° F. The range that is in use lies between 105° and 140° F. Run the agitator at 20–30 r.p.m. and then add the caustic soda and agitate for about five minutes. At the end of this time lower the speed to about 5 r.p.m. and, if the refining has been done at a lower temperature, raise the temperature to 135° to 140° F. This allows the foots or soap solution to congeal or "break" which it should do within 15 minutes. Then stop the agitation, turn off the heat, and allow to stand for some time longer which may run to two hours. The clear supernatant lard can then be drawn off for clarification through the swinging suction draw-off line.

After clarification the lard may be blended with unrefined lard or it may be hydrogenated and deodorized and then disposed of as recommended above.

PART IV. CONTROLLING RANCIDITY

Many fat-containing foods products are subject to the development of rancidity when they are kept for various lengths of time. The process of becoming rancid is one in which oxygen acts on the fat and yields oxidation products with characteristic and disagreeable odors and flavors. Butter, cream, evaporated and powdered milks, fatty nuts, salad oils and dressings, mayonnaise, oleomargarine, lard, bacon, salt pork, other fat-containing meats, as well as products containing them, may all suffer at one time or another from rancidity.

The development of rancidity varies with different products and in some cases is so delayed that it seems certain that the product contains some substance which combats oxidation with the resulting rancidity. Careful study has shown that when a fat becomes rancid easily, it contains certain substances which speed up oxidation, and when the development of rancidity is unusually delayed the product contains a substance or substances called antioxidants. These results have led to the search for antioxidant which may be used to greatly lengthen the life of the product by preventing rancidity.

Some experience has shown that Chlorophyll, the green coloring matter of all green leaves, has antioxidizing properties, and so do hydroquinone and a condensation product of alpha naphthalene and formaldehyde—in fact any aromatic carbon compound with an hydrozyl group in it. The former has very limited use on account of its color, and other substances so far found may not be used in food products for one reason or another. Consequently with fats and oils and foods containing them the aim has been to keep out products which may speed up, or catalyze, the development of rancidity. Some of these catalyzers are certain metals such as solder, copper, or iron rust, and others are frequently acids, air and sunlight. Especially that part of light called ultra violet speeds up oxidation of fats. For this reason prevention sometimes takes the form of keeping the violet end of the light spectrum from getting at the fat. Certain kinds of glass or paper are properly treated to keep out the violet rays and so help prevent rancidity.

Recent work in the field of antioxidants which may be used with edible fats and oils or foods containing fat has shown that certain cereals or ground or crushed seeds may help to prevent the development of rancidity. One of the earliest products studied was sesame meal. This meal greatly delays rancidity, but it also may affect the color and flavor of the product treated with it. Some other seeds may be used such as the cereals, but one of the most promising products is a specially prepared oat flour which has little effect on color or appearance, does not adversely affect the flavor, and does markedly retard rancidity. Some of the results obtained with this product will now be discussed in more detail.

The oat flour may be applied in three general ways in the control of rancidity. First it may be applied to the surface of the product. Since oxidation starts on surfaces where air gets at the product such treatment may be quite effective. In the case of salted fatty nuts and potato chips the application to the surface in amounts varying from one to three or five per cent greatly increase the life of the product and rather effectively hold off the development of rancidity.

A second method of application is to mix the oat flour with the fat or oil. Salad oils and mayonnaise may be so treated. Usually the product treated with one or two per cent of the flour shows some change in appearance. An oil is no longer as clear. With mayonnaise this effect is not found. Butter and margarine may be so treated.

A third method is to use the oat flour in the preparation of paper, such as parchment, grease proof, or glassine paper, or the carton in which the fat, oil, or food containing them is to be wrapped. Extensive trials have been carried out with such papers and cartons and others are now under way. There are technical problems in the production of the papers or cartons which are being solved. In the case of the product it seems certain that such papers or cartons will be of much use in controlling or preventing rancidity. For example the writer has smelled very thin samples of butter spread between two layers of papers treated with the oat flour. Such samples were still sweet when butter spread between untreated samples of the same paper had turned rancid.

Besides butter and oleomargarine manufacturers, lard renderers and meat packers who handle pork products should be interested in the possible application of the oat flour or products containing it to their products. The first obvious application would appear to be in papers or cartons in which lard is packaged. If the paper or carton which directly contacts the lard has the property of retarding the development of rancidity it should prove of considerable value to the lard manufacturer. Tests of this kind are now under way.

Another possible application is in the lard itself. The proportion will probably be from one to five per cent with the great likelihood that one or two per cent will turn the trick. There is little chance that lard treated with the flour can be sold to the retail trade or to the consumer since it has lost its glistening appearance and looks dull. But in the treatment of lard sold in large packages to large consumers such as bakeries and biscuit and cracker manufacturers there would seem to be a good hope that the resulting product would produce baked goods, biscuits or crackers that would have a longer life on the shelf. The large consumer could be convinced of the merit of the product and the change in appearance would be no handicap.

Another possible application is in the manufacture of paper to be used to wrap fresh, frozen or cured pork products. Paper used to prevent freezer burn could also be made to include a proper proportion of the oat flour and thus might be given the property of also controlling the development of rancidity in frozen pork products.

In the actual process of dry curing or salting pork, papers of this nature may have little or no use. However, their properties should be investigated. In the case of box cured bacon some such paper might be used to line the box.

Sliced bacon is another product which might be kept sweet longer by the direct application of oat flour. Experiments of this kind have been carried out and it has been shown that even after the sliced bacon which has been dusted with the oat flour has stood for some days the bacon still does not look quite normal in appearance. It seems, then, that the flour may not be used on sliced bacon. Further experiment may show that there is a use for the oat flour here. Another thing to be considered is the attitude of the government with regard to such use of oat flour. If its use should prove suc-

cessful the government might well permit it under proper conditions.

While it should be kept in mind that the oat flour is useful in retarding rancidity and while it can not be relied on to prevent other types of spoilage such as souring or putrefaction, it might be that oat flour would add to the life of certain meat products such as meat loaves, sausage, or ready to serve meats by controlling and delaying the development of rancidity. In such cases the flour would need to be sterilized so as not to add to the hazard of mold growth and fermentation.

Much of this chapter is a review and a prospect. Some or many of the suggested applications may prove infeasible. It is, however, a new development that is well worth watching.

PART V. SCIENCE IN THE SALE OF LARD

Lard is relatively scarce at the present time and packers are not finding it difficult to market the product at a price which was beyond their best hopes three years ago. Consumers to a degree are getting used to paying about as much per pound for lard as they pay for hydrogenated cottonseed oil. The meat packer should feel rather happy. But the wise meat packer knows that this is a good time to consolidate his gains and to get the consumers so used to using good lard at a good price that he may later get them to using more lard at prices much better than those that held sway in 1930. With increasing supplies of lard sure to come late in 1936 or by 1937, the meat packer should now prepare to meet that situation. Since there is now less lard to go around and since the price is relatively high, some consumers have turned to other shortenings. These will need to be won back to lard and new customers will have to be gained if the larger supplies are to find a market at a price that will be satisfactory to the meat packer. There is but one way to do this. The meat packer must make uniformly good lard and he must convince the consumer of its food value and shortening ability.

The present article will set forth the ways in which science can help the packer to do a better job of selling lard. Before doing this it might be well to remind ourselves that with every 100 pounds of pork products merchandised, 27 pounds of lard must go into consumption. Put in another way, every 100 pounds of live hog produces 70 pounds of pork products and lard. This 70 pounds is made up of 55 pounds of pork products and 15 pounds of lard. This 15 pounds of lard is 27 per cent of the 55 pounds of pork products. In terms of total production this has meant from 2 to 2.6 billion pounds of lard per annum for each year since 1927.

In the year 1930 about 7 out of every 24 pounds of lard was exported. In the years since then there has been a decrease in both the proportion and the total weight of lard sent out of the United States. At the present time the foreign market has shrunk still further and it looks as though it might disappear entirely. In the meantime the European production of hogs has been rapidly increasing, and so we may soon have to depend upon our own markets for the consumption of all lard and other products of the hog.

There are other factors which affect the present or prospective market for lard. One is the relative and increasing abundance of vegetable fats and oils both domestic and imported. There are such quantities and such varieties that competition is keen and someone has referred to the conflict as the battle of the fats. Still another reason is the tendency on the part of the consumer to eat more sugar and less cereals as well as less fat. Perhaps also modern living conditions make less demand upon one's energy for both work and heat than did the rigorous out-of-doors winter life of an earlier period.

These are all potent factors and some affect all oils and fats. We can do little to offset them, excepting perhaps by tariffs against imports or some such artificial means. There are two other reasons which weigh more or less heavily with the consumer, but which need *not* remain good reasons if the meat packer follows the suggestions in this article. These reasons are the present measures

of quality and food value to which fats are subject. Specifically, the merchandiser of hydrogenated cottonseed oil shortening, by clever publicity work, has set up certain standards of blandness, whiteness, smoking point and keeping qualities as those which *all* cooking fats should meet. At the same time the nutrition expert has told us that certain fats are good or rich sources of vitamins, while lard is lacking in them.

Flavor in Lard

This question of flavor in fats is an interesting one. Let us consider a few examples of changing point of view regarding taste.

Olive oil was once the standard oil for salads, for the making of mayonnaise, or French dressing. It had a distinctive and decided flavor. The oil imported from France or Italy was considered to be a "fancy" article. When the California oil came on the market some considered it to be inferior in flavor to the imported product. To this point of view the reply was made that the preference for some imported oils was really a preference for slightly rancid oils and that non-rancid oils would naturally be milder in flavor. But admitting the pertinence of this point of view, every one knew that olive oil had a distinctive flavor not possessed by salad oils produced from such products as corn. Many families at the time of the World War had to resort to corn oil for mayonnaise making. It was hard to get used to this oil after the use of olive oil, but after a time the corn oil was perfectly satisfactory and many families have never returned to olive oil. In fact if they now tried to return to olive oil they might not like the flavor. If circumstances forced such a return I am sure that after a little adjustment olive oil would again be preferred. Thus we can build up a preference for either bland or distinctively flavored oils.

Another illustration is furnished by butter. The flavor of butter made from properly ripened cream is distinctive and much in favor. Many people who might have been persuaded to give up butter for oleomargarine have not done so because they preferred the butter flavor. Some butter, it must be admitted had a distinctive flavor which might in all justice be called "strong". A discriminating taste would prefer a carefully-made butter that lacked this strong flavor. Recently, unsalted butter made from unripened cream has become the butter of the hour in many high class hotels and other public eating places. To my notion such butter, while avoiding the disagreeable flavor of badly made, strong butter, has gone too far in the other direction and is a tasteless, insipid product when compared to salted butter made from properly ripened cream. I do not doubt that one can find groups of people who favor any one of the three types of butter to the other two. But who shall say that sweet cream butter is preferred by all palates to a good creamery butter?

The point I am getting at is that lard, good lard, has a flavor preferred by many housewives and their families. Others can be taught to like it or prefer it unless we all permit the producers of bland fats to sell the idea that blandness or tastelessness is, of itself, a virtue. Why should lack of flavor in a fat be preferred by some to a distinctive and pleasant flavor? Is butter out of favor because it has a pleasant and distinctive taste? Why then should a tasteless hydrogenated cottonseed oil product be superior to lard because of the fact of its tastelessness? It is simply that the cottonseed oil people have been telling the prospective consumer that blandness

Sales Points for Lard

1. Easy to Digest

The oft-repeated statement that lard is indigestible is entirely untrue. Experiments by the U. S. Department of Agriculture show that lard is 97% digestible, whereas hydrogenated vegetable oils average 93.8%.

2. Has Pleasant Flavor

Flavor is the most important thing in cookery. Lard has a distinctive *natural* food-flavor, and it imparts to other foods a pleasing and appetizing taste and aroma; something a tasteless oil cannot do.

3. Superior Shortening Agent

Lard has the highest shortening power of any of the plastic cooking fats. Thousands of "shortometer" tests show that lard has a shortening value of 100% as compared with 70% for hydrogenated cottonseed oil. Obviously, lard is best for piecrust.

4. Easier to Use

A very important practical point: At a temperature of 32° F., lard is plastic enough to handle conveniently, and it remains plastic as the temperature increases, so that it may be used at ordinary room temperatures with perfect success. It does not become unmanageable until the temperature rises considerably above the average. A fat that does not remain plastic does not shorten so readily.

5. Recognized as Best

The majority of cooks and bakers recognize that lard makes the flakiest and tastiest piecrust and that it is the best shortening for bread, biscuits, and buns. It is now known that lard may also be used advantageously in certain types of cake—especially spice cake, chocolate cake, and cookies.

6. Uniform Results

While lard may be either smooth or grainy, the difference is not one of quality, but of chilling method. Likewise, lard produced by the various methods will differ in appearance. However, all lards are equally good as shortening agents, and it is simply a matter of personal preference as to which the customer shall buy.

or lack of flavor is a desirable quality and telling her often enough to make her believe it. The meat packer should recognize this situation. He should first be certain that he *is* making a lard of good quality and distinctive and appealing flavor. Then he should sell flavor to the consumer.

Color in Lard

Much the same may be said for whiteness or the appearance of whiteness. The attribute does not represent purity excepting in the sense that lack of any coloring pigment (or disguising its presence by whipping in air) may appear to signify freedom from impurity. Does anyone prefer a white butter substitute to a normal colored butter? If whiteness is the result of refining it may accompany lack of quality and purity, since refining may remove the vitamins along with the color. In the case of lard, differences in color may indicate differences in treatment of the lard or differences in source of the lard. Lard made from killing fat has a different color than lard made from cutting fat, and pickle trimmings give still a different color. Aside from these natural differences, increased color may indicate overheating during rendering. The renderer of course should avoid such abuses.

In the attempt to meet the standards of color which many packers feel must be met (and which, by the way, may have been largely set by the manufacturers of low-color shortenings) many packers use too much fuller's earth in the refining kettle and thereby damage the keeping qualities of the lard.

Smoking Point of Lard

A relatively high smoking point may be a desirable quality in a fat to be used for deep-fat frying, as in the cooking of doughnuts. In so far as a high smoking point represents freedom from free fatty acids, it does represent quality. But a high smoking point of itself has nothing to do with the use of a fat in pastry, bread, or cake making. *A good lard gives excellent results in deep fat frying when the fat is held at a lower temperature than that required in the case of a hydrogenated cottonseed oil.* Thus, the smoking point can hardly be used as a single or universal measure of relative quality in cooking fats. This is a fact which the salesman should emphasize.

Low smoking point in a lard is chiefly the result of a relatively high free fatty acid content, and thus it indicates abuse of the product or of the raw materials before they were rendered. Lard made from sweet pickle trimmings, neutral lard bottoms, and skimming will be high in free fatty acids. Such lards will have their smoking points raised as much as 100° F. if they are caustic refined. As a result, caustic refining, deodorizing and hydrogenating are processes that can be used to produce a shortening that will meet the highest requirements for smoking point. Really good lard should not be so treated, however, for the process decreases the shortening value.

Keeping Qualities of Lard

A cooking fat should have keeping qualities in conformity to the need for them. The fat should keep sweet for the period of time required to merchandise and sell it, as well as to get it eaten. There should be a margin of safety. Fats used by the biscuit and cracker manufacturer must stand exposure on the grocer's shelf for months. But lard used in the home for sautéing, biscuit making, or pie or cake baking does not need to have the keeping qualities of

that used by the biscuit and cracker manufacturer. Thus there is a place for cooking fats with somewhat different keeping qualities.

Applying this line of reasoning to lard, however, should not make the producer feel that he can be careless in the manufacture of his product. Lard properly made, from properly selected raw materials, and stored under correct conditions will possess satisfactory keeping qualities.

Uniformity of Lard

We are told by some that lard is lacking in uniformity, that flavor and keeping qualities, grain and melting point are not always the same, that lards do not vary in melting point with the seasons and that a higher melting point in Summer and a lower one in Winter would be a fine thing. I sometimes wonder whether these things are said in disparagement or praise of lard. Lards *do* vary in flavor, quality and physical properties and much of this variation may be produced on purpose. Kettle rendered lard, dry rendered lard, and prime steam lard will all have different and distinctive flavors. If one prefers a good kettle rendered lard why try to sell him prime steam lard, or even a bland hydrogenated lard? Again lard filled into cans while hot will show a different surface and grain than lard put over the lard roll and sent through the picker box. The incorporation of air in the product may change the appearance of color. Is it not entirely possible that some of the lack of uniformity of lard is due to response to a differing demand? This is a point the salesman should know and use.

Plastic Range of Lard

Now about this melting point matter. I believe that one of lard's great virtues is its wide plastic range. It does not need to have a different melting point with each season. It works into the pastry satisfactorily in Summer or Winter, out of the ice box, or off the pantry shelf.

Much recent work has been done by the Institute of American Meat Packers on the shortening value of lards and hydrogenated cottonseed oil types of shortening. Thousands of tests have shown that lard has a uniformly high shortening value. In contrast to it, hydrogenated cottonseed oil has but 70 per cent as much shortening value, and caustic refined lard belongs in about the same class.

Lards may, and do, vary in melting point somewhat depending upon the location in the body of the raw material, the age or finish of the animal, the type of hog and the feed. Such variations tend to disappear in a composite blended product. With the increased use of oil-bearing feeds in hog rations (for example peanuts and soy beans) it may be necessary to hydrogenate some lards to give more uniformity.

Some further words about this matter of uniformity. I take it that lard's chief use in the home is as a shortening agent. Has anyone ever shown that lard is lacking in shortening value or that it varies appreciably in this respect? All the evidence I have seen shows lard to be the best shortening agent. It is considerably better than hydrogenated cottonseed oil or hydrogenated lard. I know of no evidence to show that it is *not* uniform in *this* respect.

For what purpose does the average householder use lard and is it satisfactory for this use? Do these users find the odor, flavor, and result as expressed in the finished product unsatisfactory? Lacking actual statistics, I venture to state that the average home uses lard

for pastry and pie-crust, sautéing and perhaps for biscuits and certain cakes. Little if any deep fat frying is done there. Doughnuts and potato chips are purchased from the bakery or grocery store. In my home we use lard for shortening in pie crust and biscuits, for sautéing, and for French fried potatoes. We use butter for most cakes. My wife has a discriminating, not to say "finicky" taste. We find lard not only entirely satisfactory for our uses but we actually prefer its flavor. Other men have told me the same thing about their families. We can not be the only ones that are satisfied, for there must be millions of others to consume the billion and a half pounds of lard produced in the corn belt. Perhaps these people never heard of hydrogenated cottonseed oil, or cannot afford to buy it, or have not yet been told by some publicity agent that it is a pure, mild, sweet vegetable fat and not a "heavy greasy, indigestible animal shortening". I shall leave the answer to you.

Perhaps sarcasm and sales talk have no place in a supposedly scientific article. I recognize that there is much to be said on the other side of the questions I have discussed. But you have lard to sell. I am, therefore, interested more in what lard is good for than in what it is not good for, more in its virtues than in its alleged vices.

It can be shown that lard possesses many qualities as desirable as its competitors. In fact, some of these qualities are superior. There are various kinds of cooking fats on the market, and there exists no necessity of having all products of the same uniform properties. It should suffice to have one cooking fat that will meet the requirements of one kind of use and another that will meet the different requirements of another.

Food Value of Lard

Concerning the food value of lard, it may perhaps be stated that lard is of importance chiefly as a rich source of calories. At least, this is the position that most nutrition authorities take. But let us examine the position more closely. Lard is an animal fat and as a member of that class might be expected to be more important nutritionally than merely as a source of energy.

The early work on the vitamin content of edible fats showed butter to be a good source of the fat soluble vitamin while lard was devoid of it. This, however, was before vitamins A and D had been differentiated and before vitamin E had been discovered. Likewise, the effect of heat, oxidation and alkalies upon the vitamins had not been shown. Again the feed of the animal was then not known to have an effect upon the vitamin content of the animal fat. These newer advances have shown the value of cod liver oil, butter, milk, and animal glands as sources of fat soluble vitamins, while lard and oleomargarine are still considered as lacking in this respect.

That this may not be an adequate picture of the situation is shown by the recent work of Fetter and Carlson of the University of Chicago who have demonstrated that an oleomargarine made chiefly from neutral lard and oleo oil is as rich in vitamin A as butter and richer in vitamin D. Likewise Burr and co-workers at Minnesota have apparently shown that lard possesses certain unsaturated fatty acids required for the normal nutrition of laboratory animals while certain other fats (butter, for example) do not. This would seem to indicate the need for more facts concerning the food value of animal body fats, and before long you will be able to se-

cure these additional facts from The National Livestock and Meat Board.

Another valuable quality of lard not shared by the hydrogenized vegetable oils is that of flavor, and the particular significance of lard flavor in cookery should be studied and set forth. Certainly the flavor of lard is an important consideration in sautéing, deep fat frying, and the making of bread and buns. This type of investigation would lack the precision of the preceding suggestion, but valuable results can be arrived at through eating tests.

A third field in which lard has special qualities of excellence is that of plastic range. Lard can be used throughout a wider range of temperatures than can hardened vegetable oils. This is an important quality in household use. The exact plastic range of various edible fats should be investigated. There is something of a problem in connection with this study in the selection of suitable apparatus for determining plastic range. The Institute of American Meat Packers has looked into this somewhat and will be glad to share its findings with anyone interested in a study of this problem.

The National Live Stock and Meat Board has also assisted and sponsored work on the food value and use of lard. The salesman can get much help from them in the way of bulletins and other material which tell the story of lard and its use.

Likewise agricultural experiment stations in Corn Belt states are doing work on lard, and some bulletins are now available which help to tell the story.

The meat packer, therefore, has much material at his disposal which should help him sell his good lard at a good price

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